Molecular Breast Imaging (MBI) describes nuclear medicine technologies which employ dedicated gamma cameras for imaging the functional uptake of a radiotracer in the breast. Through research at Mayo Clinic over the last 9 years, we have developed a dual-head semiconductor cadmium zinc telluride gamma camera system for MBI and evaluated its promising clinical role in settings such as the preoperative workup of patients with breast cancer, monitoring response to neoadjuvant therapy, and screening in women with mammographically dense breasts. We recently demonstrated that the addition of MBI to screening mammography significantly increases detection of mammographically occult cancers in dense breasts.

Despite these findings, the systemic radiation dose received from MBI with standard intravenous administration of Tc-99m sestamibi (typically 20-30 mCi) is associated with more than 10 times the effective radiation dose of a screening mammogram. To allow safe implementation of MBI in the screening setting, recent work has focused on dose-reduction schemes for MBI, including changes to collimation, energy acceptance window settings, and post-processing denoising algorithms.

This lecture will provide an overview of the advantages and disadvantages of various breast imaging technologies with respect to imaging dense breasts and illustrate the potential clinical role of MBI. The radiation risks associated with MBI will be discussed and compared to radiation risks from mammography and background radiation. Ongoing technical work to reduce radiation dose necessary for MBI screening will be presented.

Educational Objectives:

1. Appreciate the impact of breast density on the efficacy of screening mammography.
2. Discuss the potential clinical role of Molecular Breast Imaging technologies for imaging dense breasts.
3. Understand the radiation risks associated with MBI and current dose-reduction strategies for MBI.